77. (added) The attachment member as claimed in claim 72 and wherein the substrate is formed of a ceramic material and the contacts are bumps having asperities formed by a doinking process.

Remarks

By the Office Action claims 44-70 (Group I) and claim 71 (Group II) are subject to a restriction requirement. Accordingly, claim 71 has been withdrawn.

Objection To Specification Under 35 USC §112

The specification has been objected to as not providing antecedent basis for claims 45-49, 52-56 and 59-69. In response to this objection, claims 45-47 and 52-54 have been amended. Antecedent basis for the added recitations along with added claim 26 is provided as shown in the following table. Claims 59-69 have been canceled.

With respect to claims 48, 49, 55 and 56 which contain the recitation of "semiconductor fabrication techniques", this objection is traversed. Antecedent basis for this recitation is provided on page 14, lines 19-24. It is submitted that the exact fabrication techniques, although not detailed, could be implemented by one skilled in the art. In addition, as stated on page 14, line 13 "The intermediate substrate is preferably formed of silicon".

ANTECEDENT BASIS TABLE

Claim	Recitation	Specification	Drawings
45, 52	"bumps"	p. 15, line 24	(61) Figs. 5-6
45, 52	"asperity"	p. 17, line 3	(69) Figs. 4-5
46, 53	"point"	p. 9, line 9	(73) Fig. 6
47, 54	"materials"	p. 9, lines 3-6 p.15, lines 14-16	
76	"flexible"	p.14, line 26	

Rejection of Claims 45-70 Under 35 USC §112

Claims 45-70 have been rejected under 35 USC §112 as being indefinite. In response to this rejection, independent claims 44 and 51 have been amended. In addition, claims 59-69 have been canceled and replaced with added claims 72-77.

Independent claim 44 now includes recitations that define the "contacts" as including a "raised portion adapted to penetrate" the die with the contact and raised portion "shaped and dimensioned so that when a predetermined force is applied to the contact the raised portion will penetrate its respective contact location while the contact abuts the contact location thereby limiting penetration depth at the contact location."

It is submitted that amended independent claim 44 as well as its dependent claims 45-49 are now definite. It is further submitted that the above noted recitations distinguish the invention from the prior art. Furthermore, added claims 72-77 contain similar definite and distinguishing recitations.

With respect to the confusion concerning the recitations of the Z-axis pad in claims 50, 57 and 70, these claims have been canceled. Independent claim 51 has been amended to define the attachment member as including the Z-axis pad. In claim 51, the structure and function of the contacts and the Z-axis pad are now definitively stated.

Rejection of Claims 44-70 under 35 USC §102

Claims 44-70 have been rejected under 35 USC 102(b) as being anticipated by Lehman-Lamer (U.S. Patent No. 4,963,225), Kawade et al. (U.S. Patent No. 5,072,116), Leedy (U.S. Patent No. 5,103,557), Yanagi et al. (U.S. Patent No. 5,107,206), Littlebury et al. (U.S. Patent No. 5,177,438) or Liu et al. (U.S. Patent No. 5,177,439).

In response to these rejections, independent claims 44 and 51 have been amended. The invention, as presently claimed, is directed to an attachment member adapted to provide an ohmic contact with a contact location (e.g., bondpad) of a discrete semiconductor die while at the same time limiting damage to the contact location. This is accomplished with a contact structure that projects from the substrate (e.g., bumps) and includes raised portions (e.g., asperities or points) that penetrate into the contact location to make the ohmic contact. The contacts and their raised portions are shaped and dimensioned such that penetration into the contact locations of the die is limited to prevent damage to the contact locations during a testing procedure. It is submitted that the references do not disclose this specific structure nor teach its function.

The Lehman-Lamer reference, as shown in Figure 2F, discloses a contact device that includes contact bumps 66 formed of a metal (column 3, line 17). These contact bumps 66 do not include a raised portion, as presently claimed, for piercing the contact location on the die. Furthermore, there is no provision or suggestion in this reference of limiting the penetration of the contact bumps to prevent damage to the contact location. In this regard, the substrate is not defined as a contact limiting surface and is not equivalent to the structure presently claimed. It is thus submitted that the presently claimed invention is novel and also unobvious over this reference.

The Kawade reference discloses a microprobe 4 formed as a faceted apex. A faceted structure formed on a substrate is not the same as a projection formed on a substrate having raised portions for penetrating the contact location. Although the substrate may function to limit penetration of the microprobe, this structure is not equivalent to the one presently claimed (i.e., a projecting structure formed on a

substrate and a raised portion formed on the projecting structure). In addition, there is no disclosure or suggestion of a penetration limiting function for the Kawade microprobe. It is thus submitted that the presently claimed invention is novel and also unobvious over this reference.

The Leedy reference discloses probe tips formed on a flexible tester surface. In the embodiment illustrated in Figure 24, the probe tips 386-1, 386-2, 386-3 comprise a compressible material (col 13, line 55) formed of several layers of flexible silicon dioxide or silicon nitride (col 14, line 10) with a hard metal tip 388-1, 388-2, 388-3 (column 14 lines 11-16) formed thereon. As shown in Figure 25, the tips 388-1, 388-2, 388-3 of the probe 386-1, 386-2, 386-3 are pointed to pierce the oxide coating on a contact pad 294-1 (column 13 line 62) but are not adapted to pierce the contact pad itself. Rather the probe tips 386-1, 386-2, 386-3 are adapted to flex so that the contact pad on the die is not pierced. With the presently claimed structure, on the other hand, the contacts and their raised portions are formed such that the raised portions pierce the contact pad on the die and the contact abuts the die to limit penetration.

Thus although the structure of the Leedy probe tips is similar to that presently claimed, the function is different and a different function is specifically taught. It is thus submitted that the present invention is novel over the Leedy reference. It is also submitted that in view of the teaching away aspects of this reference that the present invention is unobvious over Leedy (see for example, W.L. Gore & Associates, Inc. v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983)).

With respect to the Yanagi reference, the Yanagi probe tips 108a and 108b are shown in Figures 13A and 13B. As with the previous rejections, the structure and function of these probe tips is different than that presently claimed.

Specifically, the Yanagi probe tips are not contacts having raised portions to provide a penetration limiting function. The Yanagi probe tips could do serious damage to a contact location.

The Littlebury reference discloses contacts, which as shown in Figure 2, are adapted to flex and move through an arc in order to "scrub across a bonding pad" (column 1 line 61, column 2 line 29). The Littlebury contacts are thus not adapted to pierce the bonding pad as presently claimed. Furthermore, there is no suggestion of a penetration limiting function as presently claimed. It appears further that the Littlebury contact is sized (Figure 2) such that any piercing of the bond pad by the contacts would effect a large amount of damage to the pad.

The Liu reference discloses a probe card formed with pyramidally shaped conductive protrusions 11 (Figure 2) or 41 (Figure 4). The pyramidal projections are capable of penetrating an oxide layer of the semiconductor die (column 3, line 52). However, as previously argued, there is no penetration limiting structure other than the substrate itself. As previously argued, this structure is not equivalent to the presently claimed structure (i.e., a projecting contact having raised piercing portions) and would not provide the same function.

In view of the numerous differences between the references and the amended claims, it is submitted that the rejections under 35 USC §102 have been overcome. It is further submitted that added claims 72-77 are novel and unobvious over the references taken alone or in any combination. Independent claim 72 contains patentably distinguishing recitations similar to those previously identified in claim 1. In addition, independent claim 72 contains an additional recitation of a substrate bondpad and

bond wire in electrical communication with the contact. This structure is not suggested by any of the references.

Rejections Under 35 USC §103

Claims 50, 57 and 70 have been rejected under 35 USC §103 over the previously cited §102 references taken in combination with Arai (U.S. Patent No. 4,571,542), Koromegawa et al. (U.S. Patent No. 5,177,528), Chang et al. (U.S. Patent No. 5,206,585), Yoshida et al. (U.S. Patent No. 5,219,765) or Svendsen et al. (U.S. Patent No. 5,262,718).

The rejected claims include the Z-axis pad as an element. All of the rejected claims have been canceled due to the §112 rejection. However, independent claim 51 has been amended to overcome the §112 rejection but to include the Z-axis pad as an element.

In general, each of the references disclose the use of a Z-axis conductive pad in various articles. Admittedly Z-axis conductive pads are known in the art and used in testing apparatus. It is submitted however, that the combination of elements contained in independent claim 51 is not suggested by any combination of references.

Specifically, none of the references disclose the use of a Z-axis conductive pad with an attachment member that includes a substrate formed with projecting contacts having raised portions, circuit traces formed on the substrate to the contacts, and bondpads on the substrate for connecting bond wires to the circuit traces. It is submitted therefore that the embodiment claimed in claims 51-56, viewed as a whole, is unobvious over the cited combination of references.

Only the Chang reference involves a testing apparatus for semiconductor devices. However, an attachment member as presently claimed is not utilized. In Chang the solder bumps 14 (Figure 1) must be formed on the chip 10 in order to conduct the test procedure. With the present invention, the

attachment member effects the connection and special solder bumps on the chip are not required.

In view of the amendments and arguments, it is respectfully submitted that claims 44-49, 51-56 and 72-77 are now in a condition for allowance. Should any other issues remain it is requested that the Examiner contact the undersigned by telephone. As Associate Power of Attorney was previously filed in this case appointing the undersigned as an Attorney for Applicant. A copy is included for reference.

DATED this 27th day of June, 1994.

Respectfully submitted:

Stephen A. Gratton
Registration No. 28,418
Attorney for Applicant

10275 Gumbark Place
San Diego, CA 92131
Telephone: (619) 621-9045

ATTACHMENT: ASSOCIATE POWER OF ATTORNEY

CERTIFICATE OF MAILING UNDER 37 C.F.R. §1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage prepaid, in an envelope addressed to: Commissioner of Patents and Trademarks, Box Non Fee, Washington, D.C. 20231, on this 27th day of June, 1994.

Stephen A. Gratton
Attorney for Applicant

June 27, 1994
Date of Signature